

## CLAIMS

- 1 1. An apparatus comprising:  
2 at least one processor;  
3 a memory coupled to the at least one processor;  
4 a cluster engine residing in the memory and executed by the at least one  
5 processor;  
6 a job residing in the memory and executed by the at least one processor, the job  
7 including:  
8 at least one work thread that performs at least one predefined task; and  
9 a main thread that receives messages from at least one computer system  
10 coupled to the apparatus, that routes appropriate messages from the at least one  
11 computer system to the at least one work thread, and that signals to the cluster  
12 engine when at least one fault occurs when the at least one work thread performs  
13 the at least one predefined task.
- 1 2. The apparatus of claim 1 wherein the at least one predefined task comprises a  
2 protocol that includes at least one acknowledge (ACK) round, and that performs only  
3 local processing between ACK rounds.
- 1 3. The apparatus of claim 1 wherein the main thread performs only local processing.
- 1 4. The apparatus of claim 1 wherein the main thread does not wait for any local  
2 resource, and thus is guaranteed to receive a message sent by the cluster engine.
- 1 5. The apparatus of claim 1 wherein the signal to the cluster engine comprises an  
2 unregistration with the cluster engine



1 7. A networked computer system comprising:  
2 a cluster of computer systems that each includes:  
3 a network interface that couples each computer system via a network to  
4 other computer systems in the cluster;  
5 a memory;  
6 a cluster engine residing in the memory and executed by the at least one  
7 processor;  
8 a job residing in the memory and executed by the at least one processor,  
9 the job including:  
10 at least one work thread that executes a predefined protocol that  
11 includes at least one acknowledge (ACK) round, wherein the protocol only  
12 performs local tasks between ACK rounds; and  
13 a main thread that registers with the cluster engine to become a  
14 member of a group, that receives messages from at least one computer  
15 system coupled to the apparatus, that routes appropriate messages from the  
16 at least one computer system to the at least one work thread, and that  
17 signals to the cluster engine when at least one fault occurs when the at  
18 least one work thread performs the at least one predefined task by  
19 unregistering with the cluster engine, wherein unregistering with the  
20 cluster engine causes the cluster engine to generate a membership change  
21 to remaining members of the group.





1 14. A computer-implemented method for notifying jobs that form a group in a  
2 clustered computing environment when a member of the group is no longer alive, the  
3 method comprising the steps of:  
4 defining a protocol that includes at least one acknowledge (ACK) round, and that  
5 performs only local processing between ACK rounds;  
6 providing a cluster engine for each member of the group that communicates with  
7 the other cluster engines in the group;  
8 providing at least one work thread for each job that executes at least a portion of  
9 the protocol;  
10 providing a main thread for each job, the main thread performing the steps of:  
11 registering with the cluster engine to become a member of the group;  
12 receiving messages from other members of the group via the cluster  
13 engine corresponding to the main thread;  
14 routing appropriate messages from the other members of the group to the  
15 at least one work thread;  
16 wherein the main thread performs only local processing and does not wait  
17 for any local resource, and thus is guaranteed to receive a message sent by the  
18 cluster engine;  
19 unregistering with the cluster engine when at least one fault occurs during  
20 execution of the protocol.

1 15. The method of claim 14 wherein the step of unregistering with the cluster engine  
2 causes the cluster engine to generate a membership change message to remaining  
3 members of the group.

- 1 16. A program product comprising:  
2 (A) a computer program comprising:  
3 at least one work thread that performs at least one predefined task; and  
4 a main thread that receives messages from a corresponding cluster engine,  
5 that routes appropriate messages from the cluster engine to the at least one work  
6 thread, and that signals to the cluster engine when at least one fault occurs when  
7 the at least one work thread performs the at least one predefined task; and  
8 (B) signal bearing media bearing the computer program.
- 1 17. The program product of claim 16 wherein the signal bearing media comprises  
2 recordable media.
- 1 18. The program product of claim 16 wherein the signal bearing media comprises  
2 transmission media.
- 1 19. The program product of claim 16 wherein the at least one predefined task  
2 comprises a protocol that includes at least one acknowledge (ACK) round, and that  
3 performs only local processing between ACK rounds.
- 1 20. The program product of claim 16 wherein the main thread performs only local  
2 processing.
- 1 21. The program product of claim 16 wherein the main thread does not wait for any  
2 local resource, and thus is guaranteed to receive a message sent by the cluster engine.
- 1 22. The program product of claim 16 wherein the signal to the cluster engine  
2 comprises an unregistration with the cluster engine





- 1 24. A program product comprising:  
2 (A) a computer program comprising:  
3 at least one work thread that performs a predefined protocol that  
4 includes at least one acknowledge (ACK) round, wherein the protocol only  
5 performs local tasks between ACK rounds; and  
6 a main thread that registers with the cluster engine to become a  
7 member of a group, that receives messages from at least one computer  
8 system coupled to the apparatus, that routes appropriate messages from the  
9 at least one computer system to the at least one work thread, and that  
10 signals to the cluster engine when at least one fault occurs when the at  
11 least one work thread performs the at least one predefined task by  
12 unregistering with the cluster engine, wherein unregistering with the  
13 cluster engine causes the cluster engine to generate a membership change  
14 to remaining members of the group; and  
15 (B) signal bearing media bearing the computer program.
- 1 25. The program product of claim 24 wherein the signal bearing media comprises  
2 recordable media.
- 1 26. The program product of claim 24 wherein the signal bearing media comprises  
2 transmission media.

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